

PATENT SPECIFICATION

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(54) APPARATUS FOR ARTIFICIAL RESPIRATION AND/OR OTHER MEDICAL PURPOSES

(71) We, TANTRIMUDALIGE ANTHONY DON MICHAEL and EDWARD HENRY LAMBERT, both British Subjects, of SQ. 1044, Braim, Abadan, Iran, and SQ. 1697, Abadan, Iran, respectively, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention is concerned generally with apparatus for medical purposes, where a fluid is to be introduced into and/or withdrawn from, a body passage, and is particularly though not exclusively applicable to artificial respiration or resuscitation. The older techniques of artificial respiration have now been largely replaced by "mouth-to-mouth" respiration, using either the direct method or "kiss of life" in which the medical attendant exhales directly into the mouth of the person to be revived, or the indirect method in which air is exhaled into an airway usually in the form of a short plastics tube inserted into the mouth of the patient.

Resuscitation by expired air has certain advantages over the older techniques but also has a number of draw-backs. It is to some extent aesthetically unpleasant, a substantial part of the respirator effort is wasted in inflating the stomach, and there is a serious risk that the stomach contents will be aspirated through the oesophagus into the mouth and throat passages, with consequent gastric spillage into the respiratory passages. If the latter occurs complete failure of the procedure may follow.

The only alternative method available at the present time is to insert an endotracheal tube, but this requires an anaesthetist with hospital facilities. Obviously resuscitation is needed for persons who drown, are asphyxiated, or have sudden heart arrest, and these events may occur at any time or place, often where a hospital is quite inaccessible.

Accordingly it is one object of the invention to provide an improved apparatus, for resuscitation and/or other medical purposes which

will overcome some of the disadvantages of existing equipment.

Broadly stated the invention consists in an apparatus for medical purposes comprising an elongated tubular member constructed and arranged to be inserted into the oesophagus and having an outer end and an inner end, a radially expandible element carried by the member at a point displaced from its outer end, means for causing the element to expand radially so as to form an effective seal with the walls of the oesophagus, an inlet adjacent the outer end of the member and a discharge port in the member located between the outer end and the expandible element, and a duct within the elongated member providing fluid communication between the inlet and discharge port, this duct being closed off at a point between the discharge port and the inner end so as to prevent fluids directed along the duct to the discharge port from discharging out of the inner end of the tubular member, and also to prevent any fluid from flowing into the inner end of the tubular member to the discharge port.

Preferably the expandible element comprises an inflatable member, and conveniently the expandible element is operated in response to the supply of fluid through an auxiliary conduit extending along and within the tube. The inflatable member may be connected via the auxiliary conduit to an external inflator unit, and preferably the inflator unit includes an expandible pressure indicator member.

The duct within the tubular member is preferably of relatively large bore, i.e. it occupies the greater part of the internal cross-sectional area of the tubular member. The duct can therefore be used as an air resuscitation tube to supply air to the respiratory passages of the patient.

In addition the apparatus may include a secondary conduit extending along the length of the tubular member, past the expandible element, to an opening on the remote side thereof, at the inner end of the tubular member. This secondary conduit will thus have no communi-

cation with the duct referred to. Thus when the expandible element is inserted into and seals the oesophagus, this secondary conduit can be used to wash out or void the stomach contents, without risk of gastric spillage into the respiratory passages.

In any case the tubular member is preferably curved, to facilitate insertion through the mouth into the oesophagus, and the outer end of the tubular member may be connected or connectable to a mouthpiece. The apparatus may also include a mouth shield, and/or bite tube, at the outer end of the tubular member.

The invention may be performed in various ways and two specific embodiments, with some possible modifications, will now be described by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a somewhat diagrammatic perspective view, partly in section, of one form of apparatus in accordance with the invention, designed for artificial respiration only,

Figure 2 is a similar illustration of another embodiment having facilities both for artificial respiration and for stomach washing or evacuation,

Figure 3 is a fragmentary sectional view on an enlarged scale through an alternative form of mechanically operated expander, which may be used at the inner end of the apparatus.

The apparatus illustrated in Figure 1 consists of a main tube 10, constituting the tubular member referred to above, and formed for example of a synthetic plastics material having some rigidity, but also a degree of flexibility. The tube is curved as shown to facilitate insertion through the mouth of a patient over the tongue into the oesophagus. To assist this insertion the inner leading end of the tube is provided with a guide tip 11 having a rounded blunt nose. The outer end of this tube 10 is connected via a coupling 12, which may be relatively more flexible, to another tube 13 which forms a mouth piece by which the medical attendant can apply exhaled air for resuscitation. At the junction between the tube 10 and the coupling 12 there is provided a cup-shaped flange or mouth shield 14 to fit over the mouth of the patient, and adjacent this part of the tube 10 a rigid inner tube may be fitted, for example of steel, to act as a bite tube to prevent the tube 10 being closed or damaged by the patient's teeth. The tube 10 is provided with a transverse wall or seal at 15, and above this point, i.e. on the side adjacent to the inlet, the wall of the tube 10 is formed with a considerable number of discharge apertures 16 spaced along the length of the tube, and also preferably spaced around its peripheral wall. When the leading end of the tube is inserted through the patient's mouth into the oesophagus, these apertures 16 provide satisfactory communication with the respiratory passages, even if some of the apertures are closed.

Adjacent the leading inner end of the tube there is provided an inflatable sealing element comprising a radially expandible resilient tubular wall 20, formed for example of a synthetic rubber material. This resilient wall may be in the form of a tubular sheath positioned around and outside the wall of the main tube 10, and sealed thereto at both ends, or it may itself constitute part of the wall of the main tube, in which case it will be of reduced wall thickness, or of a different material, to provide the necessary flexibility and resilience. In the embodiment illustrated in Figure 1 the inflatable wall 20 is a separate sheath element surrounding the main tube wall 10. In order to expand this element 20 an auxiliary conduit in the form of a small bore tube 21, also preferably formed of a flexible synthetic plastics material, extends within the main tube 10 and is connected at its outer end via a branch 22 to an inflater unit comprising a manual pressure bulb 23 connected via an on-off valve 24 and a balloon type inflatable pressure indicator 25 to the branch. It will be seen when the valve 24 is open, pressure applied to the bulb 23 will force air down the tube 21 into the inner inflatable element 20 causing this to expand radially against the walls of the oesophagus to form a seal therein. The pressure indicator balloon 25 is so formed that when the inner inflatable element 20 expands, the pressure indicator will also expand to show that the oesophagus is closed. If there is any leak in this air system the balloon pressure indicator will deflate to warn the operator. When the inflatable element is expanded the valve 24 can be closed to hold it in this condition.

In using the apparatus to resuscitate a patient the main tube 10 can be inserted without difficulty through the mouth into the oesophagus, with the inflatable element 20 collapsed. This is a non-traumatic procedure and can be used by a trained ambulance man or nurse. Pressure is then applied to the bulb 23 to cause the element 20 to expand within the oesophagus so as to close off the stomach from the respiratory passages, and artificial respiration can then be performed by breathing into the mouth tube 13 in the normal manner without risk of inflating the stomach, or of gastric spillage into the respiratory passages. It will be noted that the air duct within the main tube occupies the greater part of the internal cross-sectional area thereof, thus facilitating flow of air to and from the respiratory passages.

The apparatus illustrated in Figure 2 is in many respects identical with that illustrated in Figure 1, and similar parts are indicated by the same reference numerals. In this case the guide tip 11 at the leading end of the main tube 10 is provided with a longitudinal passage provided with a seal 30 through which projects a small bore stomach washing tube 28. This tube 28 extends within a guide tube

31 passing through the inflatable element 20, along the length of the main tube 10, through the wall 15, and having an external entrance branch 32. The outer end 29 of the tube 28 is connected to apparatus (not shown) for supplying washing water or other dosing fluids, or to a pump for evacuating the stomach contents.

In this form of the apparatus the stomach tube 28 is slidable within the tube 10 and may be partly withdrawn initially into the guide tip 11 as the apparatus is inserted into the oesophagus, and then extended as necessary through the passage in the guide tip into the stomach.

It will be understood that a variety of modifications are possible. For example the apparatus may be used in conjunction with an oxygen mask, and instead of using exhaled air the inlet to the tube 10 may be connected to a bellows, or to a compressed air supply or pump. The expandible element may take various different forms, and may be fluid-operated as illustrated or may be operated mechanically, or electrically. For example, as illustrated in Figure 3, which illustrates an alternative construction applicable to the inner end of the apparatus illustrated in Figure 1, the expandible element may be in the form of a flexible rubber sleeve 35 which is contracted axially between a fixed abutment 36 and a movable abutment 37, so as to expand radially as shown in dotted lines at 40, the axial movement being effected by a flexible tension member such as a cord 38 passing within the tube 10, and opposed by a tension spring 39. An electro-mechanical transducer such as a solenoid may also be used to operate the expandible element. The main air tube 10 is preferably of oval external cross-section to reduce the risk of the tube entering accidentally the patient's respiratory passages or lungs.

In yet another form of the invention (not illustrated) a single common tube is used both to introduce air into the respiratory passages, and also to inflate the expandible element, so that the expandible element is inflated simultaneously when air under pressure is delivered to the respiratory passages. For example in the case of the apparatus illustrated in Figure 1 the tube 21 and the inflator unit 23, 25, would be omitted.

WHAT WE CLAIM IS:—

1. Apparatus for medical purposes comprising an elongated tubular member constructed and arranged to be inserted into the oesophagus and having an outer end and an inner end, a radially expandible element carried by the member at a point displaced from its outer end, means for causing the element to expand radially so as to form an effective seal with the walls of the oesophagus, an inlet adjacent the outer end of the member and a discharge

port in the member located between the outer end and the expandible element, and a duct within the elongated member providing fluid communication between the inlet and discharge port, this duct being closed off at a point between the discharge port and the inner end so as to prevent fluids directed along the duct to the discharge port from discharging out of the inner end of the tubular member, and also to prevent any fluid from flowing into the inner end of the tubular member to the discharge port.

2. Apparatus as claimed in claim 1, in which the expandible element comprises an inflatable member.

3. Apparatus as claimed in claim 2, including an auxiliary conduit extending along the tubular member and connected to the expandible element and through which the expandible element is operated in response to the supply of fluid fed through the auxiliary conduit.

4. Apparatus as claimed in claim 3 including an external inflator unit connected to the outer end of the auxiliary conduit.

5. Apparatus as claimed in claim 4, in which the inflator unit includes an expandible pressure indicator member.

6. Apparatus as claimed in any of the preceding claims, in which the tubular member is curved, to facilitate insertion through the mouth into the oesophagus.

7. Apparatus as claimed in any of the preceding claims, in which the outer end of the tubular member is connected to a mouthpiece.

8. Apparatus as claimed in claim 7, including a mouth shield and bite tube, at the outer end of the tubular member.

9. Apparatus as claimed in any of the preceding claims, in which the duct is an integral part of the tubular member, and the discharge port comprises a plurality of openings in the side wall of the tubular member.

10. Apparatus according to any of the preceding claims, including a secondary conduit extending along and within the tubular member from a position adjacent the outer end thereof to the inner end thereof and having an inner end terminating in an opening.

11. Apparatus according to claim 10, wherein the secondary conduit is a separately formed tube, and is movable lengthwise within the tubular member to vary the projection of the said secondary conduit beyond the inner end of the tubular member.

12. Apparatus according to any of the preceding claims, in which the duct within the tubular member occupies the greater part of the internal cross-sectional area of the tubular member.

13. Apparatus for medical purposes substantially as described with reference to Figure 1, or Figure 2, or Figure 1 as modified by Figure 3, of the accompanying drawings.

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2 SHEETS

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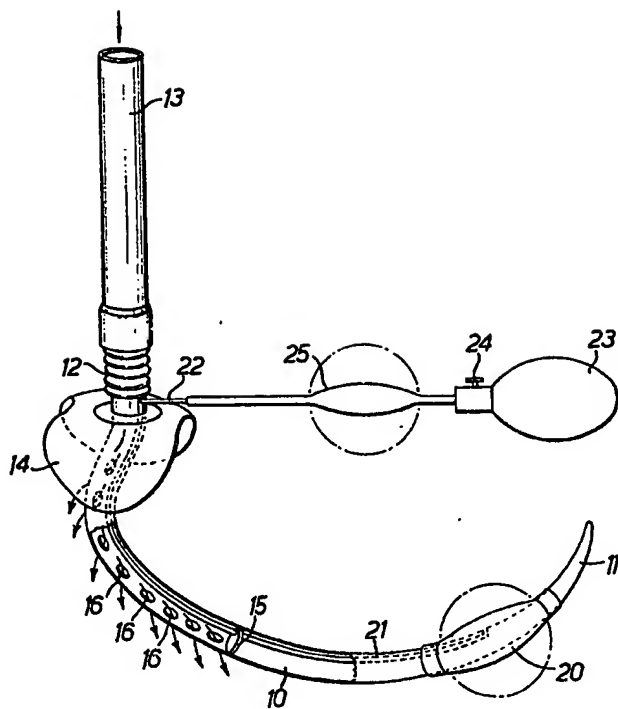


FIG. 1.

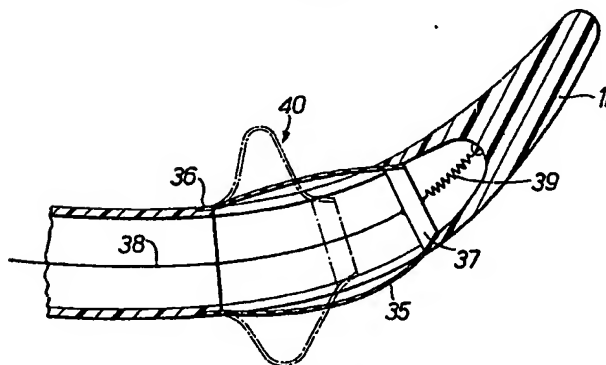


FIG. 3.

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COMPLETE SPECIFICATION

2 SHEETS

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Sheet 2

